

Message Text

PAGE 01 STATE 245133
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C O N F I D E N T I A L STATE 245133

USOECN, EXCON

E.O. 11652: XGDS-1

TAGS: ESTC, COCOM, UR, US

SUBJECT: US MULTIPLE COMPUTER SYSTEMS TO USSR--IL 1565

REF: A) PARIS 27327, B) COCOM DOC (77) 589 (BEWT 252123)

THE FOLLOWING ARE ANSWERS TO THE QUESTIONS RAISED BY
GERMAN DEL IN COCOM --

1. SEISMIC DATA PROCESSING MAY BE CHARACTERIZED BY:

A) THE LARGE VOLUME OF DATA TO BE PROCESSED - SEVERAL
MILLION SAMPLES PER JOB;

B) THE USE OF A VARIETY OF SOPHISTICATED PROGRAMS, WHICH
ARE DEPENDENT ON THE DATA BEING PROCESSED AND THE RESULTS
DESIRED.

CONFIDENTIAL

PAGE 02 STATE 245133

ADDITIONALLY, THE EFFECTIVE UTILIZATION OF MEDIUM SCALE
COMPUTERS, LIKE THE CYBER 172, REQUIRES A MULTI-PROGRAM-
MING APPROACH TO OPERATION; I.E., THE CONCURRENT EXECUTION
OF SEVERAL JOBS OR PROGRAMS. THE CYBER 172 HAS A MAXIMUM
MEMORY LIMIT OF 7.9 MEGABITS. IT IS THEREFORE NOT
POSSIBLE FOR THE PROGRAMS AND DATA OF EVEN ONE JOB TO
BE PRESENT IN THE CENTRAL MEMORY.

GIVEN THE INADEQUACY OF CENTRAL MEMORY TO HOLD THE
NECESSARY PROGRAMS AND DATA, IT IS NECESSARY TO SEGMENT

THE JOBS. BASED ON COMPUTER HARDWARE ARCHITECTURAL AND SEISMIC APPLICATION CONSIDERATIONS THE PROGRAMS AND DATA WERE SEGMENTED INTO BLOCKS OF 2000 WORDS OF 60 BITS. A COMPARISON OF THE PERFORMANCE OF THESE BLOCKS WHEN STORED ON DISKS OR EXTENDED CORE STORAGE (ECS) FOLLOWS:

	AVERAGE ACCESS TIME	TRANS.RATE (M-BITS/SEC.)	TRANS.TIME FOR 2K SEGMENT
844 DISK	33.3 MO.	2.84	75.6 MS.
ECS	3.2	300.0	0.4

THE TRANSFER OF A 2K SEGMENT BETWEEN CENTRAL MEMORY AND A 100 MEGABYTE DISK FILE, LIKE THE CDC 844, IS APPROXIMATELY 187 TIMES LONGER THAN IF ECS IS USED. IT IS THEREFORE ESSENTIAL THAT FREQUENTLY USED PROGRAM SEQUENCES AND INTER-MEDIATE RESULTS BE STORED IN ECS.

FROM AN APPLICATIONS STANDPOINT, 70 MS OF CYBER 172 CENTRAL PROCESSOR TIME ARE REQUIRED, STATISTICALLY, FOR A SEISMIC MODULE AND THAT THIS SEISMIC MODULE WILL AVERAGE 3 SEGMENTS OF PROGRAMS AND 4 SEGMENTS OF DATA; THAT IS 7 SEGMENTS.
CONFIDENTIAL

PAGE 03 STATE 245133

WITH ECS, A ROUGH ESTIMATE OF THROUGHPUT TIME WOULD BE:

70 MS OF COMPUTATION IN THE CPU; PLUS
2.8 MS OF ECS INPUT/OUTPUT TIME; OR

72.8 MS TOTAL

WITHOUT ECS

70 MS OF COMPUTATION IN THE CPU; PLUS
529 MS OF DISK INPUT/OUTPUT TIME; OR

599 MS TOTAL

ECS WILL THEREFORE GIVE AN 8 TO 1 PERFORMANCE ADVANTAGE OVER THE 844 DISK FOR SEISMIC APPLICATIONS ON THE CYBER 172.

THE ECS INCLUDED IN THIS CASE IS IDENTICAL TO THAT PREVIOUSLY APPROVED FOR INSTALLATION UNDER COCOM DOC. (76)1260 AT THE MINISTRY OF GEOLOGY, NARO-FOMINSK, USSR.

2. THE MATRIX ALGORITHM PROCESSOR (MAP) II IS A DEVICE WHICH WAS DESIGNED FOR SEISMIC DATA PROCESSING. A PROCESSING DATA RATE CANNOT BE CALCULATED AS THE MAP II PERFORMS ARITHMETIC COMPUTATIONS ONLY IN FIXED POINT. THE CPU BUS RATE IS 48 MEGABITS PER SECOND.

A GENERAL DESCRIPTION OF THE MAP II FOLLOWS:

HIGHLIGHTS:

-- TWELVE OPERATING AND CONTROL REGISTERS

-- COMPUTATION IN FIXED POINT

CONFIDENTIAL

PAGE 04 STATE 245133

-- 16K WORD OF CORE MEMORY; WORD SIZE OF 24 BITS

-- OPERATION CONTROLLED BY CDC 6000 OR CDC CYBER PERIPHERAL PROCESSING UNIT (PPU)

DESCRIPTION:

THE MAP II CONSISTS OF THE FOLLOWING FUNCTIONAL UNITS:

-- CDC CYBER-INTERFACE UNIT

-- MEMORY UNIT

-- ARITHMETIC AND CONTROL UNIT

CDC CYBER-INTERFACE UNIT:

THE MAP II IS ATTACHED TO A CDC CYBER 172 CHANNEL BY WAY OF A 6681 DATA CHANNEL CONVERTER. THE OPERATION OF THE MAP II IS CONTROLLED BY THE CDC CYBER PERIPHERAL PROCESSOR USING A SET OF EXTERNAL FUNCTION CODES. THE SUSTAINED DATA TRANSFER RATE OF THE MAP II IS LIMITED BY THE SPEED OF THE CDC CYBER DATA CHANNEL TO 12 BITS EVERY 2 MICROSECONDS OR ONE 24-BIT DATA WORD EVERY 4 MICROSECONDS.

MEMORY UNIT:

OPERANDS AND INSTRUCTIONS ARE CONTAINED IN THE 16K WORDS (0.39 MEGABIT) OF CORE MEMORY. THE WORD SIZE IS 24 BITS. BECAUSE OF THE PHYSICAL STRUCTURE, THE MEMORY CONSISTS OF TWO 8192-WORD MEMORIES. THESE 8K MEMORIES ARE FURTHER DIVIDED INTO TWO 4096-WORD BANKS. MEMORY CYCLE TIME IS 1 MICROSECOND PER BANK. THIS RESULTS IN AN

CONFIDENTIAL

PAGE 05 STATE 245133

EFFECTIVE SPEED OF TWO MEMORY REFERENCES EVERY 0.5 MICROSECOND (WHEN ADDRESS INCREMENTS ARE ODD).

ARITHMETIC AND CONTROL UNIT:

CONTROL OF THE ARITHMETIC INSTRUCTIONS IS ACCOMPLISHED BY A SET OF 12 CONTROL REGISTERS. THESE REGISTERS HOLD THE

STARTING ADDRESS, INCREMENT VALUES OF THE OPERAND AND RESULT ARRAYS, AND TERMINATION CONTROL INFORMATION. INSTRUCTIONS ARE 24 BITS LONG AND ARE STORED IN THE MAP MEMORY. THE INSTRUCTION SET INCLUDES JUMP, REGISTER-LOAD, STORE, ADD, SHIFT INSTRUCTIONS, AND SIX ARITHMETIC INSTRUCTIONS FOR PERFORMING:

- HIGH-SPEED CONVOLUTION
- REAL CONVOLUTION
- COMPLEX CONVOLUTION
- STACK
- INTERPOLATION
- HIGH-SPEED SUM OF SQUARES

THE RESULTS OF THESE OPERATIONS ARE ACCUMULATED UP TO 60 BITS, AND CAN BE UNLOADED TO THE MAP MEMORY OR THE DATA CHANNEL.

ARITHMETIC OPERATIONS ARE PERFORMED IN FIXED-POINT AND ARE ORIENTED TO TIME DOMAIN PROCESSING.

OVERFLOWS ARE DETECTED BY THE HARDWARE.

INSTRUCTION SPEEDS:

FOR A MAP II, EQUIPPED WITH FOUR MULTIPLY ADDERS, THE INSTRUCTION SPEEDS ARE AS FOLLOWS:

- HIGH-SPEED AND REAL CONVOLUTION, 125 NANoseconds PER MULTIPLY-ADD
- COMPLEX CONVOLUTION, 1 MICROSECOND PER MULTIPLY-ADD

CONFIDENTIAL

PAGE 06 STATE 245133

- STACK, 500 NANoseconds PER POINT
- INTERPOLATION, 1 MICROSECOND PER POINT

THESE TIMES ARE ONLY VALID UNDER THE ASSUMPTION OF OPTIMUM CONDITIONS AND DO NOT INCLUDE TIMES FOR LOADING OPERANDS AND UNLOADING RESULTS.

THE MAP II INCLUDED IN THIS CASE IS IDENTICAL TO THAT PREVIOUSLY APPROVED FOR INSTALLATION UNDER COCOM DOC. (76) 1260 AT THE MINISTRY OF GEOLOGY NARO-FOMINSK, USSR.

3. THE CDC 2550-2 HARDWARE HAS BEEN MODIFIED TO LIMIT THE TRANSMISSION SPEED OF EACH COMMUNICATION CHANNEL TO 1200 BPS FULL-DUPLEX OR 2400 BPS HALF-DUPLEX. IT SHOULD BE NOTED THAT THE ONLY PURPOSE OF 2550-2 IS TO INTERFACE THE INTERACTIVE GRAPHIC TERMINAL TO THE CYBER 172 AND THAT ALL OF THE EQUIPMENT WILL BE LOCATED WITHIN THE COMPUTER OPERATING AREA.

4. THE HEWLETT PACKARD (HP) INTERACTIVE GRAPHIC SYSTEM

IS BASED ON A TEKTRONIX 4014-1 GRAPHIC DISPLAY TERMINAL.
THIS DISPLAY INCLUDES A VECTOR GENERATOR AND IS THEREFORE
NOT EXEMPTED BY NOTE 1 OF IL 1565. THE HP SYSTEM DOES
NOT EXCEED THE NOTE 12 EXCEPT FOR THE INCLUDED
GRAPHIC DISPLAY. A BRIEF DESCRIPTION OF EACH PRODUCT
FOLLOWS:

THE TEKTRONIX 4014 GRAPHIC TERMINAL IS A LOCAL OR REMOTE
TERMINAL WHICH HAS TWO DISPLAY MODES, ALPHA-NUMERIC AND
GRAPHIC.

HIGHLIGHTS:

CONFIDENTIAL

PAGE 07 STATE 245133

- OPERATES IN HALF- OR FULL-DUPLEX MODE
- COMMUNICATION SPEED SELECTABLE TO 9,600 BITS PER
SECOND
- CONTAINS A 15-BY 11-INCH DIRECT VIEW STORAGE CATHODE-
RAY TUBE (CRT)
- VECTOR DRAWING SPEED OF 4,000 INCHES PER SECOND
- FIVE TYPES OF VECTOR GRAPHIC DISPLAY MODES

DESCRIPTION:

THE TEKTRONIX 4014 GRAPHIC TERMINAL CONSISTS OF A DIRECT
VIEW BISTABLE STORAGE TUBE AND KEYBOARD. UP TO 8,512
ASCII CHARACTERS CAN BE DISPLAYED ON THE 15-BY-11 INCH
CRT. IN GRAPHIC MODE, 4,096X BY 4,096Y POINTS CAN BE
ADDRESSED. THE OPTIONAL GRAPHIC MODES ARE DOTTED-LINE
AND DASHED-LINE VECTORS, POINT PLOT, INCREMENTAL PLOT,
AND WRITING BEAM BRIGHTNESS. INPUT TO THE TERMINAL IS
ACCOMPLISHED EITHER THROUGH THE KEYBOARD OR A THUMBWHEEL
CONTROLLED CROSS-HAIR CURSOR.

A TEKTRONIX 4631 HARD COPY UNIT PROVIDES AN 8 1/2-BY-11
INCH HARD COPY OF THE CRT DISPLAY BY LIGHT EXPOSURE ON
DRY-SILVER PAPER. THE COPY TIME IS APPROXIMATELY 18
SECONDS.

SEISMIC INTERPRETATION ON THE TEKTRONIX 4014 GRAPHIC
TERMINAL IS ACCOMPLISHED WITH AN INTELLIGENT CONTROL UNIT--
THE HEWLETT PACKARD MODEL 21-M/20.

THIS MODEL IS A MICROPROGRAMMED, GENERAL-PURPOSE MINICOM-
PUTER. SINCE THE CONTROL SECTION IS IMPLEMENTED IN READ-
ONLY MEMORY, THE PROCESSOR CANNOT BE MICROPROGRAMMED BY THE
USER. FLOATING POINT INSTRUCTIONS ARE IMPLEMENTED WITH
MICRODE.

THE PROCESSOR IS EQUIPPED WITH 0.26 MEGABIT OF MOS MEMORY.
CONFIDENTIAL

PAGE 08 STATE 245133

EACH MEMORY WORD IS 16 BITS WIDE PLUS 1 BIT FOR PARITY.
MEMORY CYCLE TIME IS 0.65 MICROSECOND AND MAY BE EXPANDED
TO 1 MILLION WORDS. ADDITIONAL OPTIONS INCLUDE A MEMORY
PROTECT SYSTEM, NINE I/O CHANNELS, AND A MEMORY REFRESH
BACKUP BATTERY SYSTEM.

THE INTERACTIVE GRAPHICS SUBSYSTEM IS CONNECTED TO THE
CDC CYBER SYSTEM USING 1200 BPS FULL-DUPLEX LINES.

COPIES OF DATA SHEETS ARE ATTACHED:1/

- A. CRT DISPLAY ANALYSIS ATTACHMENT 4, PG 10 OF 12
- B. CRT DISPLAY ANALYSIS ATTACHMENT 4, PG 11 OF 12
- C. CPU PARAMETER ANALYSIS ATTACHMENT 4, PG 12 OF 12
- D. DATA SHEET ON 4014-1/15-1

5 AND 6 - SEISMIC DATA IS BEING COLLECTED WITH TWO
SEISMIC EXPLORATION VESSELS EQUIPPED WITH TOWED ARRAYS OF
GEOPHONES AND SEISMIC RECORDING EQUIPMENT BY CGG-COMPAGNIE
GENERALE DE GEOPHYSIQUE (FRENCH CO.). TWO SUCH VESSELS
ARE CURRENTLY OPERATING IN OFF-SHORE WATERS NEAR SAKHALIN.
ONE ADDITIONAL VESSEL WILL ALSO BE SUPPLIED BY CGG. THE
SEISMIC DATA COLLECTED BY THESE VESSELS IS TO BE PROCESSED
ON THE SYSTEM PROPOSED IN COCOM DOC (77) 589. IT IS USG
UNDERSTANDING THAT NO GRAVIMETERS ARE USED IN THE COLLECTION
OF THIS SEISMIC DATA.

7. BASED ON AN ANALYSIS OF DATA RECEIVED FROM THE
EXPORTERS ON-SITE MONITOR AND INFORMATION AVAILABLE TO
U.S. AUTHORITIES, THE SYSTEM CONTINUES TO BE USED FOR THE
APPROVED PURPOSE.

IT WOULD NOT BE REALISTIC OR APPROPRIATE TO DECIDE THE
CONFIDENTIAL

PAGE 09 STATE 245133

EXPORTABILITY OF A SYSTEM ON OTHER THAN ITS PERFORMANCE
AND END-USE. OTHERWISE, IT WOULD BE NECESSARY TO ESTABLISH
LIMITS ON THE QUANTITY OF SYSTEMS INSTALLED BY COCOM
COUNTRIES TO THE SOVIET UNION AND OTHER EAST EUROPEAN
COUNTRIES.

1/ DATA SHEETS HAVE BEEN AIRMAILED FROM COMMERCE ON
10/7/77. USG WISHES TO REMIND DEL THAT SUBJECT CASE IS
MOST URGENT. VANCE

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<< END OF DOCUMENT >>

Message Attributes

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